A POSSIBLE NEW SOURCE OF FOOD SUPPLY

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MUCH attention has been given during the last few years to the question of foods. We have learned to use in our bakings and to like on our table various substitute flours that hitherto were not considered worthy of trial. Many of the flours have proved to be palatable and nourishing.

Among the many products which the Indians have taught us to use may be mentioned such common and now indispensable foods as corn and potatoes. Probably when man first sampled potatoes he did not relish them, but gradually learned to like them. Likewise the white man has learned to use corn and both corn and potatoes are now considered indispensable foods.

There are, however, many products which the Indians used and relished that have received little or no attention from the white man. The common cat-tail (*Typha*) is one of these products. Parker,[1] in speaking of the "Iroquois Uses of Maize and other Food Plants," says:

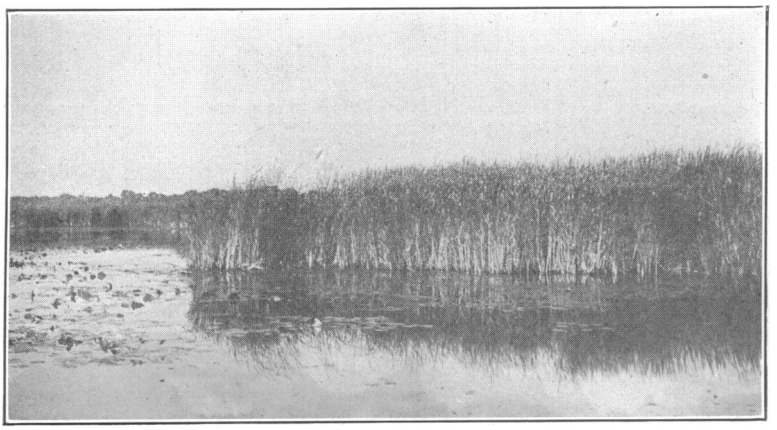
> The roots of the cat-tail were often used. Dried and pulverized the roots made a sweet flour useful for bread and pudding. Bruised and boiled fresh, syrupy gluten was obtained in which cornmeal pudding was mixed.

Others have spoken of the possibility of the cat-tail plant as a source of food supply. J. D. Hooker, in his "Descriptive and Analytical Botany," page 827, says: "The pollen of *Typha* (cat-tail) is made into bread by the natives of Scind and New Zealand." And again the botanists, Engler and Prantl, state that "the rhizome rich in starch may serve as food material."

The vast areas of cat-tail have been little utilized. Here is a plant with prolific growth, rich in starch and other products of food value, growing in situations now regarded as waste lands.

The cat-tail is a perennial plant with large underground rootstalks or rhizomes. Several of these rhizomes originate from a single plant. They spread in all directions and run underground for distances of twelve to thirty inches or more, then suddenly turn and come out and form other stalks. Thus

[1] Museum Bulletin 144, N. Y. State Museum.



A TYPICAL CAT-TAIL MARSH.

in any cat-tail patch three to four inches under the surface of the ground one finds an irregular network of these rhizomes. To these rhizomes are attached the roots and root-hairs which gather the food material from the soil. The rhizomes, which measure three fourths to one inch in diameter, are the storing places for the reserve food that has been manufactured by the green leaves. The center of the rhizome consists of a core of more solid material, an almost solid mass of starch. This core measures three eighths to one half inch in diameter. Surrounding this core of starch one finds a layer of spongy tissue, such as occurs around the roots of many of the swamp plants. It serves as a protection or as an insulator to the central core of the reserve food material.

During the growing season the cores of the rhizomes become filled with grains of starch. With this bountiful supply of reserve food material on hand, the cat-tail is able to send forth its new leaves the following spring just as soon as the frost is out of the ground. A remarkably rapid growth is thus insured. However, in this process of food manufacturing and storing, the cat-tail is not so different from many other plants. All plants store up food material in some form or another. The potato concentrates its food material in the tuber in the ground preparatory to the following year's crop. The sole purpose of this large starch supply in the potato is to provide enough reserve material for the young plant till it is able to maintain itself. Likewise the cat-tail provides for its "progeny." It is nature's way of insuring the maintenance of its species.

Man has taken advantage of many of the stored products of nature and come to depend upon them largely for his sus-

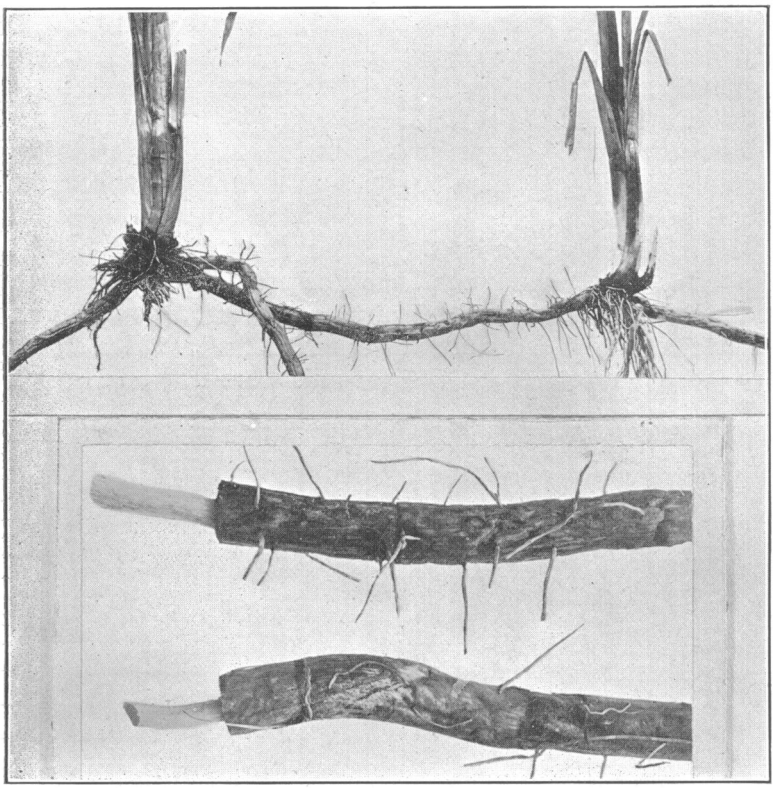
tenance, but there is still much food going to waste in so far as man's own interests are concerned. The cat-tail produces a surprisingly large amount of food material. The plant grows in situations which are at present little or not at all utilized. According to C. A. Davis,[2] there are in the United States, exclusive of Alaska, 139,855 square miles of swamp land. Thousands of acres of this land are cat-tail marshes. These marshes annually produce thousands of tons of food material. Only indirectly has man learned to reap some benefit from these cat-tails, for annually scores and scores of muskrats are trapped in the marshes. The sustenance of these muskrats consists largely of the rhizomes of the cat-tail.

Knowing that the Indians had made use of the cat-tail as a food, and knowing that such animals as muskrats thrive on this food, it was thought worth while to investigate the value of the cat-tail plant as a source of food supply. Should it prove to be of value and should it be possible or practicable to obtain the food and prepare it in some form, it might prove to be another valuable asset in this or in some other country. With an ordinary pickaxe a square yard of cat-tails were dug up in a mod-

A WALL OF CAT-TAIL.

[2] Bulletin 16, S. Doc. 151, 60th Cong., 1st Session.

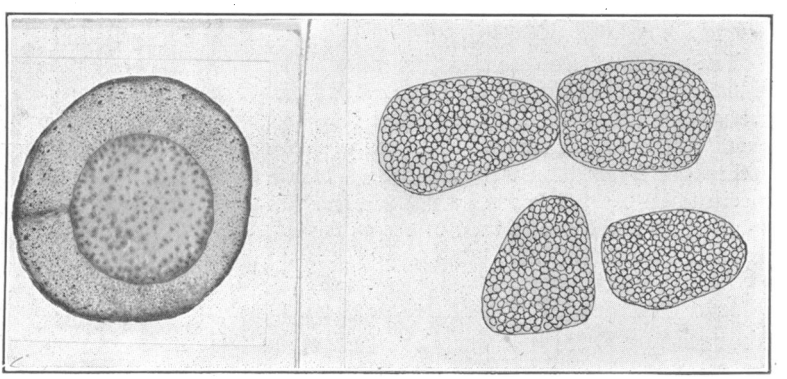
erately thick patch. The tops of the plants were cut off, the rhizomes washed and taken to the laboratory. Here the entire bundle of rhizomes was weighed. Thus the total weight of rhizomes obtainable from a square yard was found. This amounted to 6.7 pounds. Much of this weight, however, was water. The rhizomes were put upon a radiator and left till they were thoroughly dry. This required from five to eight



TWO CAT-TAIL PLANTS SHOWING THE UNDERGROUND STEMS OR RHIZOMES.
Note the new offsets at the bases of the old plants.
TWO PIECES OF RHIZOME WITH PART OF THE OUTER COVERING REMOVED TO SHOW THE RELATIVE SIZE OF THE CENTRAL CORE FROM WHICH THE FLOUR IS DERIVED.

days. The dry weight of the rhizomes was 2.23 pounds, or one third of the original weight. Calculating from these figures we find that one acre of cat-tail would yield a total dry weight of rhizomes of 10,792 pounds. The next part of the problem was to determine what part, by weight, of the rhizome consisted of the central core of starch. Various methods were employed in attempting to separate the central core from the surrounding layer of spongy tissue. It was found that while

the rhizomes were still wet the spongy tissue peeled off quite readily, in fact it could be stripped off very much in the manner that one strips off the bark of a small tree. This left the central core quite clean. If, however, the rhizomes were left till partly dry the outer layer would not separate so easily and much of the core was lost in attempting to separate the two. But if the rhizomes were left till completely dry the outer layer came off very readily and left the clean, hard central core. Careful weighings showed that in the dried rhizome the central core constituted 60 per cent. of the total weight of the rhizome. Taking 60 per cent. of the above 10,792 pounds, we find that one acre would yield 6,475 pounds of material composed of the cores. These cores contain many fibers, and our next attempts were made to separate these fibers from the rest of the material. The cores were ground up and the grindings placed in water, thus attempting to separate the starch from the fibers



CROSS SECTION OF A RHIZOME. Except for the fibers the cores are composed of a solid mass of starch.
A FEW CELLS FROM THE CENTRAL CORE MUCH ENLARGED TO SHOW THE GRAINS OF STARCH.

by gravity. This method, however, did not prove satisfactory since much of the starch went into solution and few of the fibers came to the surface. A syrupy solution also forms which tends to hold the grains of starch and the fibers together. Secondly, the dried cores were ground up finely by passing them several times through an ordinary meat grinder and then sifting through a fine mesh sieve. Much of the fibrous material was thus got rid of. The siftings proved to be a fine flour of a white or slightly creamy-white color and not much different in general appearance from wheat flour. By this crude method of separating the fibrous material from the cores we found that from 10 to 15 per cent. by weight of the cores proved to be fibrous material, leaving a net weight of 5,500 pounds of the

siftings or flour available per acre. Of course, not all of the fibrous material was got rid of by this method, but likewise part of the flour was lost with the fibers, so that the above figures probably represent a fair average estimate.

A sample of the flour thus obtained was sent to Washington to the Food Administration office. This office turned the sample over to the Plant Chemical Laboratory, where an analysis of the flour was made. This analysis shows the following composition:

Moisture	7.35 Per Cent.
Ash	2.84 Per Cent.
Fat	0.65 Per Cent.
Protein	7.75 Per Cent.
Carbohydrates	81.41 Per Cent.

Mr. J. A. LeClerc, the chemist in charge, in his report on the analysis says:

> You will see from this that this material has approximately the same amount of protein that is found in rice and corn flours. The ash content is very high, however. In this respect it approximates the amount found in potato flour and in cassava flour and in dasheen flour. The fat content is somewhat lower than that found even in wheat flour. In view of our experience on the use of flour substitutes in baking we see no reason why cat-tail flour could not be used to the extent of 10 to 20 per cent. as part substitute for wheat flour.

Two samples of the flour were also analyzed by the Food Laboratory of the University of Kansas. Sample no. 1 consisted of the flour just as the cores were ground up without attempting to remove the fibers. Sample no. 2 had the fibers removed similarly to the sample that was sent to Washington. These two samples show the following composition:

	No. 1, Per Cent.	No. 2, Per Cent.
Moisture	6.77	8.78
Ash	2.37	2.48
Protein	5.71	7.22
Fat (ether extract)	3.71	4.91
Carbohydrates (different)	83.81	79.09

It may be of interest to show in tabular form the analyses of several flours in order to compare them to the cat-tail flour. The figures in these tables for the flours other than cat-tail have been taken from Bulletin 701, U. S. Department of Agriculture, Washington, D. C.

CHEMICAL ANALYSIS OF WHEAT-FLOUR SUBSTITUTES AND OF CAT-TAIL FLOUR.

Kind of Flour	Water, Per Cent.	Ash, Per Cent.	Fat, Per Cent.	Protein, Per Cent.	Carbohydrates, Per Cent.
Spring wheat	12.00	.42	1.00	12.50	73.83
Yellow corn (raw)	6.96	.82	2.82	7.88	80.83
Rice (polished)	9.65	.36	.24	8.81	80.74
Potato (dried)	6.82	4.01	.43	12.25	74.80
Cassava	8.21	1.60	.29	1.44	86.45
Dasheen (peeled)	7.48	4.12	.46	8.00	77.80
Cat-tail (Washington analysis)	7.35	2.84	.65	7.75	81.41
Cat-tail no. 1, Univ. of Kans. anal.	6.77	2.37	3.71	5.71	83.81
Cat-tail no. 2, Univ. of Kans. anal.	8.78	2.48	4.91	7.22	79.09

A comparison of the above analyses shows that the cat-tail flour is not so different in composition from other flours and could probably well be used.

The practicability of obtaining the flour from the field is a question which deserves further attention and experimentation. Likewise the question of cultivation would require careful investigation. The fact, however, remains that there are thousands of acres of cat-tails containing considerably over two tons of flour per acre which at present finds no use.

We have found that it is not so difficult to get the flour in small quantities. Half an hour at digging and "peeling" has yielded three or four cupfuls of flour. The digging is not so different from digging potatoes and the peeling about equally facile.

We have used this flour in several ways, first as part substitute flour in baking, and secondly as a substitute for cornstarch in puddings. Biscuits made with 33 per cent. and 50 per cent. cat-tail flour were found to be very palatable. Even 100 per cent. cat-tail flour made biscuits that were not so different from biscuits made from wheat flour. Puddings made with cat-tail flour in them in place of corn starch proved to be entirely satisfactory. The flavor produced by this flour is pleasing and palatable.